MI DEQ & RETAP Pollution Prevention (P2) Training

Energy Efficiency (E2)

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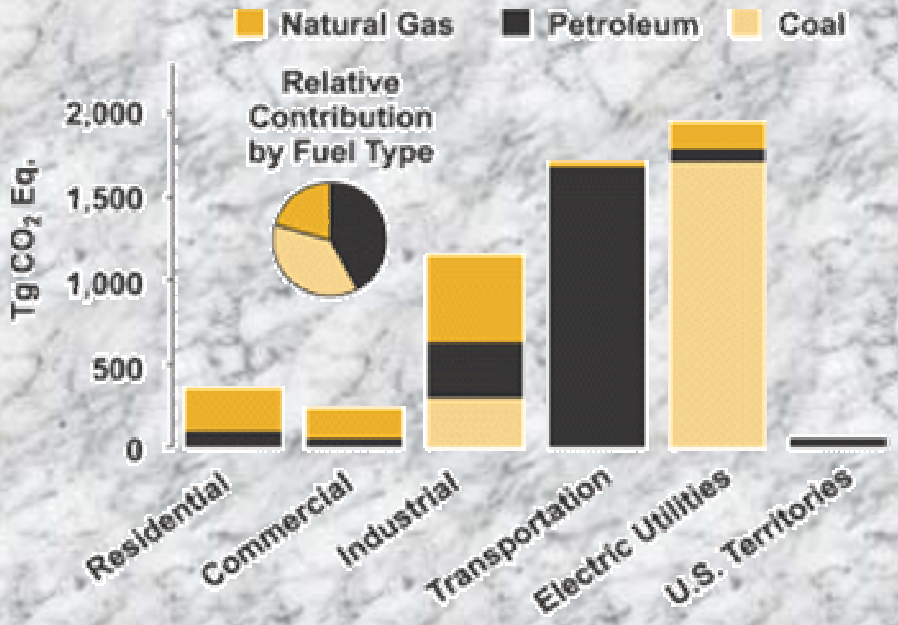
Kentucky Pollution Prevention Center

Energy Efficiency as Pollution Prevention

- **Energy Efficiency is achieving work with less energy/unit.**



Note: Utilities also includes emissions of 0.04 Tg CO_2 Eq. from geothermal based electricity generation

Source: EPA

- **Energy generation creates air pollution as a byproduct**
- **Protect natural resources by conservation.**

Energy Efficiency as Pollution Prevention

New source equivalent emission rates are:

NO_x - 1.5 LBS/MWH

SO_2 - 3.0 LBS/MWH

CO_2 - 880 LBS/MWH

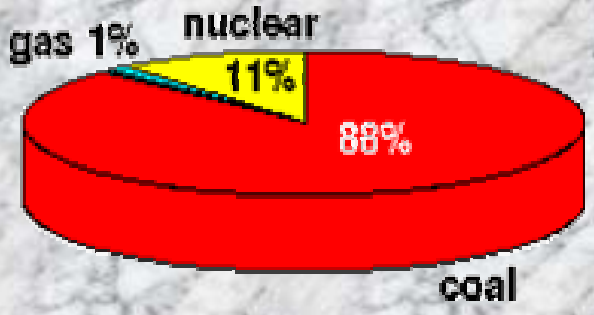
Detroit Power 1995 Data

1995 Emissions Summary

	Total Emissions		Fossil Rate		Total Rate	
	Tons	Rank	lb/MWH	Rank	lb/MWH	Rank
NO_x	166,212	5	7.92	12	7.06	9
SO_2	224,559	12	10.69	33	9.54	24
CO_2	41.2 mill.	9	1,964	43	1,751	17

Source: National Resources Defense Council

Detroit Power Fuel Source



E2 Assessment

You Are Here

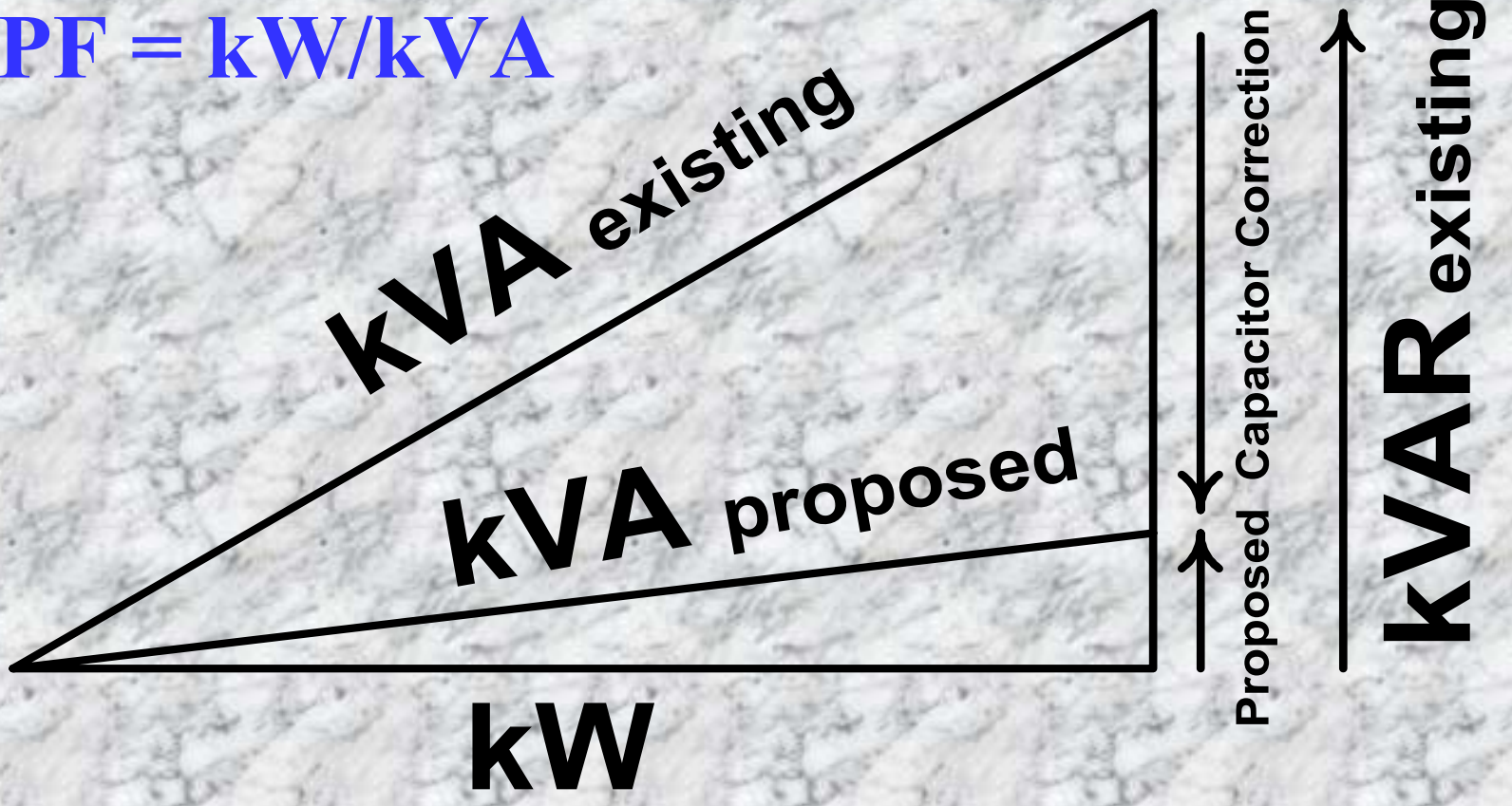
You Want To
Be Here

E2 Opportunities

- ***Demand/Power Factor Improvements***
- **Billing/Rate Structure**
- **Reduce Electrical Use**
  - ***Compressed Air Systems***
  - **Lighting**
  - **Motors and Pumps**
  - **Boilers and Steam Systems**
  - **Heating, Ventilation & AC**
  - **System Controls**

Power Factor: Components of Electrical Power

PF = kW/kVA



Power Factor

- Three effects of low power factor (<80%)
  - Robs distribution system of capacity
  - Higher currents = high voltage drop and electrical system losses
  - Billing penalties

Power Factor: Opportunities

Shooting for PF > 95%

- **Preventative Measures**
  - **High-PF motors and lighting ballasts**
- **Current Applications**
  - **Capacitors!!**

Demand/Load Factor

- Demand = kWh/time = kW
  - Usually calculated in 15-minute intervals
  - Peak Demand = highest usage in any 15-minute interval
    - ⇨Ex. 8000 kWh/0.25 hrs = 2000 kW demand
- Load Factor = avg. demand/peak demand
  - High load factor indicates relatively constant load and less potential for improvement

Id: AP012

MONTHLY DETAIL PLOT

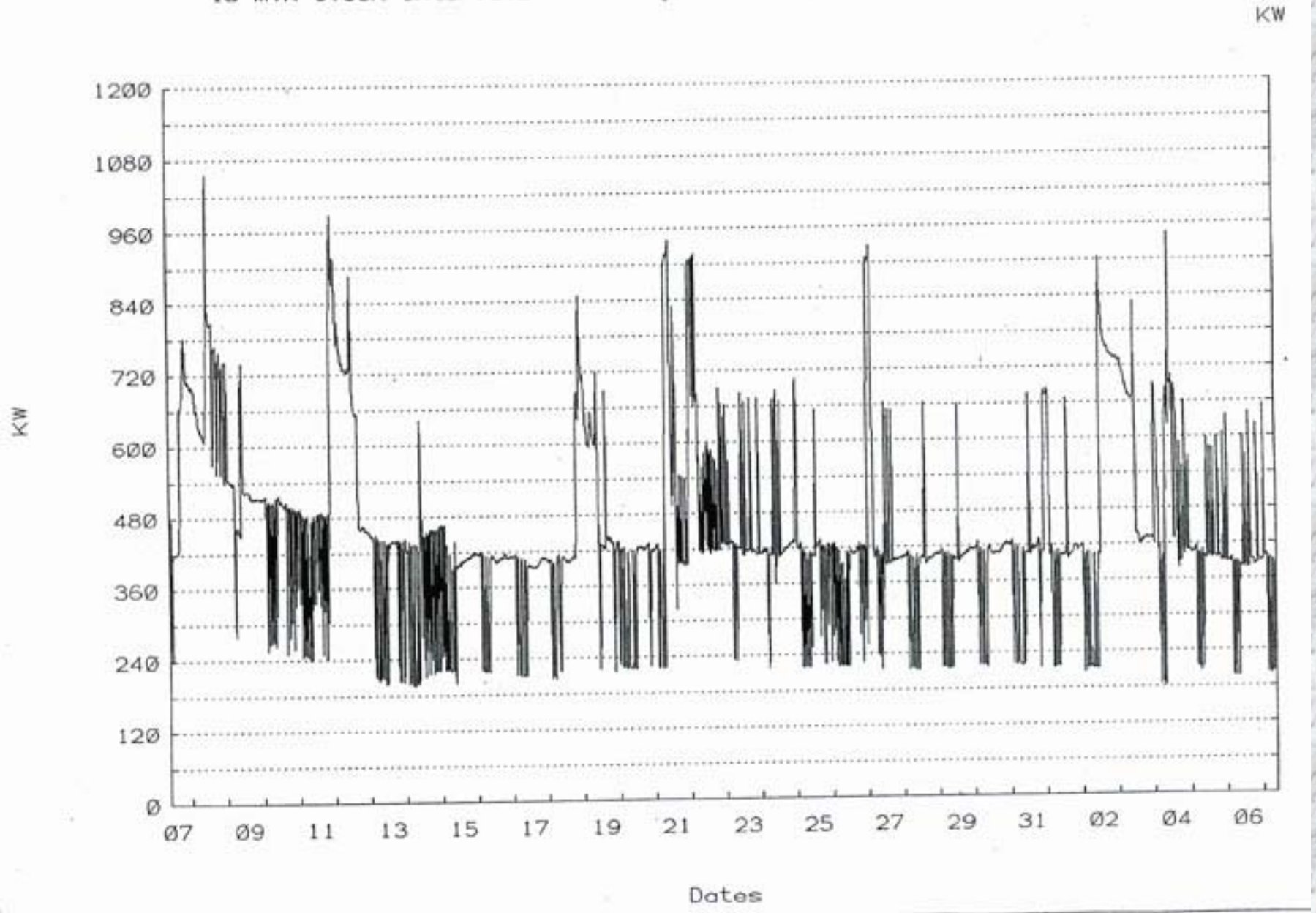
Chan: 1 06-11-2001

Name: M. S. D.

Start: 05/07/01 08:46 Max: 1056.0 KW

15 Min Clock Intervals

Stop: 06/07/01 08:30 Min: 181.8 KW



Demand Opportunities

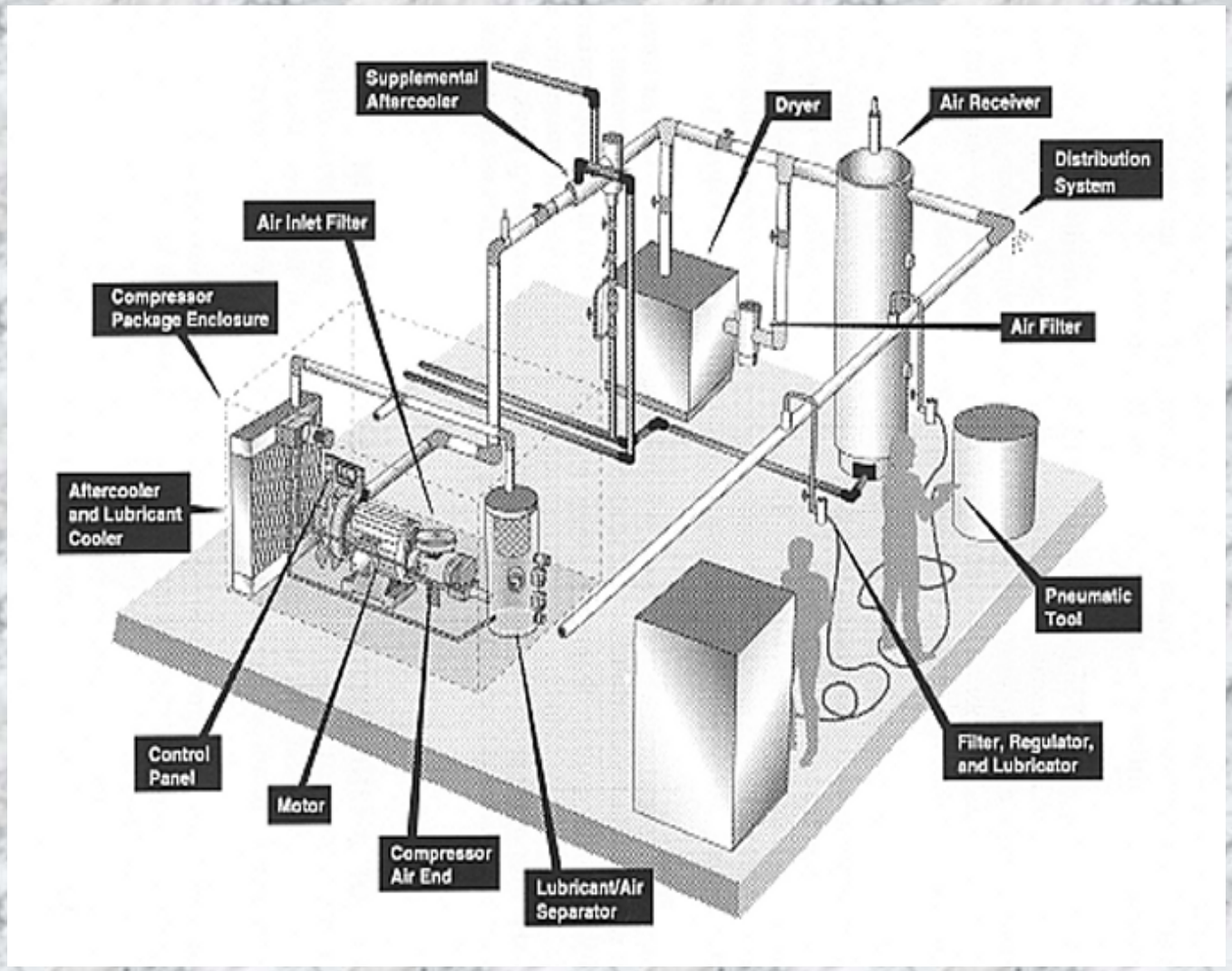
- Get Demand Profile
  - Stagger Start-up Loads
  - Reschedule Loads
- Look for Sheddable Loads
  - AC, Fans, Chillers, Compressors, Water Heaters
- Check Rate Schedule

Air is Not Free!

- Air Compressors are the “hidden” utility
  - Consumes 7-8 Hp electricity to produce 1 Hp of compressed air.
  - $100/yr to produce 1 CFM air flow.
  - $398/yr to produce 1 psig pressure.
  - A 2 psig operating pressure rise increases the operating energy costs by 1%
  - Typical ‘wire to work’ efficiency is 10%
  - Few companies know the cost/CFM
  - Few companies know their CFM usage

Sources: Compressed Air Challenge.org; Air Power

Air Compressor System



Parts of System

- **Compressor**
- **Controls**
- **Air/oil separator**
- **Aftercooler**
- **Dryer**
- **Filter**
- **Receiver**
- **Filter**
- **Regulator**
- **Lubricator**
- **Point of use**

Compressors

Reciprocating type

Rotary Screw type

Audit Questions - System

- Is the air being over treated?
- Where and how much is the leak loss?
- Can the system pressure be lowered?
- Is the control scheme right?
- Can you reuse the heat generated?

Audit Questions –Demand side

- Is the piping set up right?
  - Is abandoned equipment still there?
  - What is the pressure drop?
- What is the load profile?
- Is the air being used inappropriately?
  - Would a blower work better?
  - Can electric tools be substituted?
  - Are workers using it instead of brooms?

Audit Questions – Supply side

- Is the compressor appropriate?
- Are filters clean & appropriate?
- What is the after cooler efficiency?
- Is the dryer appropriate?
  - Size, pressure drop, efficiency
- Are the automatic drains working?
- Is there enough receiver storage?

Opportunities

- Reduce system pressure
- Correct piping backpressure points
- Minimize pressure drop in all ways
- Have a routine leak detection
  - Leaks should be held to 10% or less
- Maintain the system
- Eliminate inappropriate uses
- Heat recovery

Tools of the trade

- Ultrasonic leak detector
- Pressure gauges
- Flow meters (mass, pitot tube, orifice, thermal, ect)

- Amp meter
- Humidity meter
- Common sense

Other Resources

- **DOE**
  - **Compressed Air Challenge**
    - ⇨http://www.compressedairchallenge.org/
- **EPA**
  - **Climatewise**
    - ⇨http://www.epa.gov/climatewise/
- **National Resources Defense Council**
  - ⇨http://www.nrdc.org/air/energy/utilprof/utilitys.asp
- **CERES** (Coalition for Environmentally Responsible Economies)
  - ⇨http://www.ceres.org/publications/main.htm

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Next Steps: Let's Do an Onsite Assessment!

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